FOREST PEST MANAGEMENT
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BIOLOGICAL EVALUATION OF A PINE NEEDLE SHEATHMINER INFESTATION IN THE TANBARK FLATS K X M PROVENANCE TEST, ANGELES NATIONAL FOREST

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ABSTRACT

A pine needle sheathminer (PNSM) infestation was detected in the Tanbark Flats hybrid (knobcone X Monterey) pine progeny test outplanting in June of 1983. When evaluated in February 1984, a considerable loss of needles from the 1983 needle complement was evident. Estimates of the overwintering PNSM population indicate that the infestation will continue in 1984 at the same or possibly reduced level. Other destructive agents are contributing to the distress of the trees; most noteably smog damage and another needleminer. Management alternatives discussed include: 1) do nothing, 2) thin and control competing vegetation, and 3) control the pine needle sheathminer.

INTRODUCTION

Distressed trees were first noticed in the Tanbark Flats knobcone X Monterey plantation about June 10, 1983, and were reported by Max Copenhagen (DR 19/83) and Gaylord Parks (DR 20/83). The cause of the malady was identified as the PNSM, Zelleria haimbachi, by entomologist Dave Schultz on July 12, 1983, from samples submitted by Jeffrey Specter. By that time it was expected that adult moths would have emerged and laid eggs and Schultz recommended an evaluation be made during the winter when tiny first instar larvae are present in individual (surviving) needles of the current growth.

The plantation was visited by entomologist John Pierce on February 1, 1984. The results of the evaluation are based on subjective judgements as well as objective data interpretation. Because an established survey procedure is not available for estimating PNSM damage or predicting

population trend, an improvised survey was developed. This improvised survey of the overwintering stage - thread-like larvae mining within individual needles - necessitated examining individual needles under magnification in the laboratory. Since relatively few needles can be scrutinized in a practical and timely manner, results are based on a very small sample of the 1983 needle complement.

OBSERVATIONS

The one acre, 20 year old plantation is located on a fairly good site of moderate slope. The trees are 4 to 8 inches dbh, 15 to 20 feet tall and growing well. Originally established at 8 by 8 feet spacing, the plantation was thinned a few years ago to reduce the stocking level so that tree growth and vigor could be maintained. Now, stocking is again high and the canopy has about closed. Grass, the competing vegetation, is light and is not significantly affecting tree growth. Tree vigor, as judged by crown appearance, ranges from healthy to quite sickly. Most trees show a considerable loss of 1983 needles, largely due to defoliation by the PNSM. Additionally, the trees on the poorer end of the crown vigor scale generally suffer from chlorosis, needle tip dieback, and fewer and shorter needles. In the laboratory examination, these symptoms were confirmed as smog damage and, to a minor degree, needle tip dieback caused by another needleminer - probably a species of Coleotechnites.

In carrying out the improvised survey, branch tip samples were collected about 8 feet above the ground. Sample tips from healthy trees and sickly trees were kept separate. In the laboratory, the 1983 needle complement was examined, under magnification, needle by needle to record the overwintering larvae and needle survival. Infested needles were identified by a resinous spot - egg attachment site - from which a long, thread-like mine issues. Many of the mines were opened to confirm the presence of a live larvae. It was noted that many characteristic resinous spots had no mine associated with them, indicating that mortality of eggs and newly hatched larvae must have been high. Only 7 or 8 percent of the available needles were successfully infested. Infested needles, with only one or two exceptions, contain only one larva.

Summary of Laboratory Counts

Tip and Needle Sample

	Healthy Trees	Sickly Trees	Total/average
Tips	9	12	21
Needles	834	649	1383
PNSM Larvae	66	40	106
Larvae Per Tip	7.33	3.33	$\bar{X}$ = 5.05
Infested Needles	8%	7%	$\bar{X}$ = 8%
Needles/Tip	92.7	45.8	
Needles/Larva	12.6	13.8	

Needle Bundle Sub-Sample

	Bundles Missing	Bundles Present	Total Bundles	Total Larvae
Tip A	80	24	104	3
Tip B	41	19	60	5
Tip C	86	20	106	4
Tip D	114	37	151	10
Average	80	25		5.5

It has been estimated (Stevens, 1959) that a single larva will, on the average, destroy about 6 to 10 needle bundles of ponderosa or Jeffrey pine or their hybrids. On this basis, one would judge there were 8 to 13 larvae per tip to destroy about 80 bundles per tip in the 1983 infestation at Tanbark Flats. However, Stevens (1959) also indicates that the K X M hybrid is more severely defoliated than the ponderosa/Jeffrey group, so it may have taken fewer than 8 to 13 larvae per tip to destroy 80 bundles. This survey found 3 to 7 overwintering larvae per tip, but some additonal larval mortality will occur during the remainder of the larval stage.

These survey results indicate that the infestation is neither terminating nor increasing at a rapid rate. Defoliation in 1984 will probably be similar to that observed in 1983, except the damage may become more pronounced on what are now the healthier trees.

Some dead and top-killed pines near the plantation were examined. The examination showed that pine engraver beetles, Ips spp., are active in the area. Pine engravers could present some threat to kill the more sickly trees in the plantation.

MANAGEMENT ALTERNATIVES

1. Do Nothing. The PNSM infestation will probably continue for one or more years, but will not likely kill very many trees. Our experience and the literature both fail to record tree mortality from this pest. A continuation of the defoliation would eventually lead to tip dieback and reduced growth. With time, the increasing stocking level is likely to exacerbate the PNSM and smog damage and accelerate the decline of tree vigor and vigor of the plantation as a whole. The probability of successful attacks by pine engraver beetles occurring will increase as the vigor of the trees decline.

There is some concern that the Tanbark Flats infestation may spread to other areas. The PNSM has a wide host range among the hard pines and would be expected to attack most pine species in southern California except sugar pine. Forest insect outbreaks usually build up from local

populations when conditions are favorable for increases of that particular insect. Therefore, the threat of spread probably is only likely within the local area of Tanbark Flats where conditions for the PNSM appear now to be favorable. The PNSM probably already exists in other areas of southern California.

2. Thin and Control Competing Vegetation. For the trees to be in the best position to cope with PNSM, smog, drought, pine engravers and possibly other damaging agents, they need to have as good growing conditions as possible. Thinning, to prevent or reduce between tree competition, will help to maintain good tree growth and vigor. If thinning is done, all slash 3 inches in diameter and larger should be treated to make it unattractive to, and unsuitable for, breeding by pine engravers. Such treatments includes chipping, burning, and removal from the site. Opening the plantation canopy could invite more serious competition from weeds -- principally grass and possibly brush. If a weed problem appears to be develping, it too should be treated by appropriate methods so that tree vigor is not adversely affected.

3. Control the Pine Needle Sheathminer. Chemical suppression is the only means currently available for controlling the PNSM. Suppression would not, of course, protect against other debilitating agents such as smog.

Malathion and Orthene when used as foliar sprays, Orthene when implanted, and Metasystox R when injected could be used to control the PNSM. To be effective, the materials would have to be applied about the time most of the larvae had left their mines in individual needles, but before substantial defoliation had occurred. At the Tanbark Flats site, we judge this to be about the time the trees are just beginning to flush.

REFERENCES

Stevens, Robert E. 1959. Biology and control of the pine needle sheathminer, Zelleria haimbachi Busck. USDA, Forest Service, Pacific Southwest Forest and Range Expt. Sta. Tech. Paper 30, 20 pp., illus.